

## **Claims**

1. A muffler assembly having a piping arrangement for conveying exhaust gases from an internal combustion engine through the muffler assembly, the piping arrangement comprising:
  - at least a first pipe having a male end portion with an external wall surface;
  - at least a second pipe having a female end portion with an internal wall surface, and
  - a wire bushing disposed between the external wall surface of the male end portion of the first pipe and the internal wall surface of the female end portion of the second pipe, the wire bushing being constructed and arranged to compensate for thermal expansion between the male and female end portions of the first and second pipes, respectively.
2. The muffler assembly of claim 1 wherein the wire bushing comprises at least one strand of wire coiled on an axially extending portion of one of the wall surfaces of the male or female end portions thereof with the strand of wire frictionally engaging the wall surface of the other end portion.
3. The muffler assembly of claim 2 wherein the wire strand is secured to the wall surface by a welded joint arrangement.
4. The muffler assembly of claim 3 wherein the welded joint arrangement comprises a series of spaced spot welds along the length of the strand.
5. The muffler assembly of claim 2 wherein there are at least two layers of wire strand wrapped around the exterior wall surface of the male end portion.
6. The muffler assembly of claim 2 wherein the axially extending portion is on the male end.

7. The muffler assembly of claim 6 wherein the welded joint arrangement comprises a series of spaced spot welds of the length of the strand.

8. The muffler assembly of claim 7 wherein there are at least two layers of wire strand wrapped around the exterior wall surface of the male end portion.

9. A muffler for connecting with an exhaust pipe of an internal combustion engine, the muffler including a housing enclosing a space with a sound attenuating system therein, the muffler assembly comprising:

an array of baffle plates within the housing and first and second end cap  
5 plates closing the housing, the plates having first rates of thermal expansion and being spaced from one another to define chambers within the housing;

pipes extending through holes in the plates, wherein the holes are defined by axially extending surfaces, the pipes interconnecting the chambers and having second rates of thermal expansion different from the first rates, and

10 wire bushings between at least one of the pipes and the holes in the plates to compensate for the different rates of thermal expansion between the pipes and plates.

10. The muffler assembly of claim 9 further including an air gap down pipe connected at a first end to the exhaust pipe of the engine and at a second end to the muffler, the air gap down pipe having a core pipe and outer jacket surrounding the core pipe in spaced relation thereto, wire bushings disposed  
5 between the core pipe and jacket at the first and second ends of the air gap down pipe to compensate for different rates of thermal expansion between the core pipe and jacket.

11. The muffler assembly of claim 10 wherein the bushings comprise at least one metal wire wrapped around the core pipe and spot welded thereto to provide interrupted bearing surfaces between the core pipe and jacket at the ends of the core pipe and jacket.

12. A muffler for connecting with an exhaust pipe of an internal combustion engine, the muffler having a housing enclosing a space with a sound attenuating system therein, the muffler comprising:
- first and second end cap plates on the housing, the end cap plates each
  - 5 having a hole therethrough defined by an axially extending interior surface;
  - inlet and outlet pipes having axially extending exterior surfaces on ends passing through the holes in the end cap plates of the housing with the exterior surfaces of the pipes being adjacent to the axially extending interior surfaces defining the holes;
  - 10 baffle plates within the housing, the baffle plates each having at least one hole therethrough defined by an axially extending surface;
  - interior pipes with axially extending exterior surfaces passing through the holes through the baffle plates with the exterior surfaces of the pipes being adjacent to the axially extending interior surfaces defining the holes, and
  - 15 wire strand bushings between the interior surfaces of the holes and the exterior surfaces of the pipes to compensate for unequal thermal expansion of the plates and pipes.
13. The muffler assembly of claim 12 wherein the strand bushings are metal wire strands which have discontinuous fixed contact with the exterior surfaces of the pipes at least in the axial direction of the pipes and holes.
14. The muffler assembly of claim 13 wherein each of the bushings is comprised of at least one strand of metal wire wrapped about the exterior surfaces of the pipes in at least a first layer.
15. The muffler assembly of claim 14 wherein there is at least one additional layer of metal wire strand wrapped over the first layer of metal wire strand.
16. The muffler assembly of claim 15 wherein the first layer of metal wire strand is a helix slanting in a first axial direction and wherein the additional layer

metal wire strand is a helix slanting in an axial direction opposite the first axial direction.

17. The muffler assembly of claim 14 wherein there are more than two layers of metal wire strand each slanting in a different axial direction than layer adjacent thereto.

18. The muffler assembly of claim 12 wherein the strand bushings are made of carbon, polytetrafluoroethylene, natural fibers, or temperature resistant polymers.